REMARKS

Claims 1-17 are currently pending in the application. In an Office Action dated October 4, 2004, the Examiner required that the first sentence of the Specification be amended to indicate that the parent application is now an issued patent, rejected claims 1, 2, and 4-13 under 35 U.S.C. § 103(a) as being unpatentable over LeCrone, U.S. Patent No. 6,529,944B1 ("LeCrone") in view of VanderSpek, U.S. Patent No. 6,477,591B1 ("VanderSpek"), rejected claims 3 and 14-17 under 35 U.S.C. § 101 for double patenting, and rejected claims 1, 2, and 4-13 under obviousness-type double patenting. Applicant's representative has amended the first sentence of the specification, in order to address the Examiner's requirement for the amendment. Applicant's representative has cancelled claims 3 and 14-17 in response to the Examiner's double patenting rejection. Applicant's representative encloses a terminal disclaimer in response to the Examiner's obviousness-type double patenting rejection of claims 1, 2, and 4-13. Applicant's representative respectfully traverses the 35 U.S.C. § 103(a) rejection of claims 1, 2, and 4-13.

Please consider claim 1, provided for the Examiner's convenience, below:

> 1. (original) A method for backing up a primary logical unit within a data storage device, the primary logical unit and a backup logical unit together comprising a mirror-logical-unit pair, the method comprising:
>
> receiving a trigger I/O request by the data storage device;
>
> inserting a TRIGGER message corresponding to the I/O request into a queue that contains a portion of a sequenced stream of I/O requests directed to the primary logical unit;
>
> de-queuing the TRIGGER message from the queue, and initiating a mirror split operation directed to the primary logical unit;
>
> sending the TRIGGER message to the backup logical unit; and
>
> after completion of the mirror split operation, maintaining the backup logical unit as a backup copy of the primary logical unit.

Claim 1 directed to a process by which a host computer, in cooperation with a disk-array controller, or other data-storage-device controller, can bring both a primary logical unit and its mirror logical unit into consistent states, prior to a mirror-split operation. The host computer sends a trigger I/O request to the primary logical unit of

the disk array. When the disk-array controller receives the trigger I/O request from the host computer, the disk-array controller inserts a trigger message into a queue containing a sequenced stream of I/O requests. The trigger I/O request is a notification, by the host computer, that when all I/O operations preceding the I/O trigger request are completed, the primary logical unit and mirror logical unit will be in consistent states. Note that, for the trigger I/O request mechanism to correctly function, the disk-array controller needs to maintain a sequenced stream of I/O requests. If the trigger I/O request were to be allowed to be processed by a logical unit out-of-order with respect to normal I/O requests, then the state of the logical unit would generally not be consistent at the point the trigger I/O request was begun to be processed. When the trigger message is finally de-queued from the sequenced stream of I/O requests maintained by the disk-array controller, the disk-array controller initiates a mirror-split operation by directing a mirror-split command to the primary logical unit. The disk-array controller then sends the de-queued trigger message to the mirror logical unit, or backup logical unit, so that the backup logical unit also obtains a consistent state prior to undertaking its portion of the mirror-split operation. This technique is summarized in paragraph [0011], in the Summary of the Invention section, and in paragraphs [0034-0037].

Applicant realizes that mirror-split operations are well known in the prior art. Claim 1 is not directed to a mirror-split operation, *per se*, but instead to a method for placing both logical units of a mirror pair into consistent states prior to undertaking the mirror operation. The cited portion of LeCrone appears, to Applicant's representative, to describe a well-known mirror-split command in which a user directs a data-storage device to stop mirroring operations between a mirror pair. Note that, in line 19 of column 7, LeCrone specifically indicates that the user stops the mirroring operation. There is no mention of consistent states, a sequenced stream of I/O requests maintained by the disk-array controller, a trigger I/O request inserted into the sequence stream of I/O requests by the disk-array controller, and forwarding of a trigger message to the mirror, or backup logical unit following de-queuing of the trigger message from the sequenced stream of I/O requests queue by the disk-array controller that includes the primary logical unit. In Applicant's representative's opinion, therefore, LeCrone does not mention or suggest

even a single element of claim 1. Applicant's representative has reviewed the content of LeCrone other than the cited portion of LeCrone, and can find no mention of the clearly claimed elements of claim 1 in portions of LeCrone outside the cited portion.

VanderSpek, in the cited sections, describes an I/O request packet ("IRP") that is issued by an operating system in response to an application program calling the operating system API that can be placed by the operating system into a mirror driver's I/O request queue. It should be noted, as clearly shown in VanderSpek in Figure 3, that the mirror driver 42 is a component within a single computer system 50. In other words, VanderSpek does not concern a host computer directing mirror-split operations to a disk-array controller within a remote disk array. VanderSpek is directed to a generally unrelated field of technology. Moreover, there is no indication in the cited portion of VanderSpek that the I/O request queue contains a sequenced stream of I/O requests. Within a single computer system, it can generally be assumed that the IRPs sent by the operating system to the mirror driver will be received by the mirror driver in order. Even in a single computer system, however, there may be I/O bus errors and other error conditions that may result in out-of-order reception of transmitted requests. However, in the host computer/remote disk-array realm to which claim 1 of the current application is directed, no assumptions can be made with regard to the sequence of reception of I/O requests through a communications medium interconnecting a host computer to a remote disk array, which is why the present invention is directed to storage devices that maintain sequenced I/O request streams. In a second cited portion of VanderSpek, a special type of control IRP is described. A control IRP is processed differently from normal IRPs. As described in VanderSpek, the mirror device control waits for a mirror driver's I/O request queue to empty, prior to issuing a control IRP. This allows the mirror device control to be sure that all currently pending I/O requests represented by IRPs are executed by a mirror driver prior to execution of the special control IRP.

In Applicant's representative's opinion, this special IRP mechanism described in VanderSpek is not related to the trigger I/O mechanism to which claim 1 is directed. First, the trigger I/O request is inserted into a queue containing a sequence stream of I/O requests by a receiving disk-array controller. The disk-array controller

does not wait for the queue to empty before inserting the trigger I/O request. Second, the disk-array controller inserts a trigger message into a queue containing a sequenced stream of I/O requests. There is no mention of sequenced I/O requests in VanderSpek, most likely because the out-of-order reception problem prevalent in a host-computer/remote-disk-array system are not frequently encountered in a single computer system described by VanderSpek. Moreover, because VanderSpek's mirror device control flushes a mirror driver's queue prior to inserting the special IRP, VanderSpek's system may not need to employ a sequenced stream of I/O requests. The cited portion of VanderSpek does not indicate that a special IRP can direct a mirror-split operation. But most importantly, VanderSpek does not indicate that a special IRP, once de-queued from a mirror driver's I/O request queue, can then be forwarded to the I/O request queue of another mirror driver. Thus, in Applicant's representative's opinion, like LeCrone, VanderSpek appears not to teach, mention, or suggest even a single element of claim 1.

The above observations with respect to claim 1 apply, as well, to independent claim 11. In Applicant's representative's opinion, neither LeCrone, VanderSpek, nor LeCrone and VanderSpek in combination, teach, mention, or suggest the mirror-pair consistency mechanism via a trigger I/O request to which claims 1, 2, and 4-13 are directed. In Applicant's representative's opinion, all of the claims remaining in the application are now clearly allowable. Favorable consideration and a Notice of Allowance are earnestly solicited.

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